Water and Energy Saving Horizontal Axis Washer

"Wash Wise" Program-Tucson, Arizona

Final Report, February 26, 1999
Conservation Assistance Grant - CA97TUM85

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WATER/ENERGY SAVING HORIZONTAL AXIS WASHER "WASH WISE" PROGRAM

Table of Contents

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Final Report

Introduction

The project to evaluate the feasibility of implementing a market transformation and rebate program for front loading-horizontal axis (h-axis) washers has been completed. The following report reflects the background, findings and future directions of this program.

Background

Horizontal axis means that the washtub is oriented horizontally, like a clothes dryer. The program during this phase focused on residential single family and multi-family water and energy customers throughout the Tucson Active Management Area (AMA). Although h-axis washers are predominant in Europe, they represent a limited market share in the U.S. at present. The h-axis "tumble action" washer requires the washer tub to be only partially filled with water for proper cleaning action unlike the typical vertical axis washer (standard top loading) which has a central agitator post and must have its wash tub filled with water to cover the laundry items. The partial filling of the h-axis washer's tub results in less water use, resulting in less energy needed to heat the water.

Approximately 35 billion loads of laundry are washed annually in the U.S. (an average of 380 loads per household per year) consuming 2.6% of the total residential energy use[1]. A 1997 study in Bern, Kansas using the Maytag Neptune found that the change over to the h-axis washer reduced the average water consumption from 41.5 gallons per load to 25.8 gallons per load, a water savings of about 38%. The study also showed energy consumption with h-axis washers fell by 58% due to savings from heating less hot water and the impact of a highly efficient motor in the h-axis.

[1] "Revolution, Not Agitation: A New Spin on Clothes Washing" *Home Energy, Vol.13, No.6, November/December 1996, pp.7-8*

The remaining moisture content of damp loads removed from the h-axis washer was, on average, 7% lower than for loads removed from participants', v-axis washers[2]. The Tucson study was too limited to evaluate moisture removal during the spin cycle. However, although 3 out of 4 showed reduced residual moisture with the h-axis washer the average did not show significant reductions. In addition, regardless of the age of the v-axis washer replaced, participants found the cleaning performance of the h-axis washers to be superior across all loads, temperature settings, use of detergent and other additives.

A survey conducted through a consortium of utilities and U.S. Department of Energy (DOE) concluded that 17% of households who own a washing machine intend to purchase a new machine in the next two years. Of this number, only 0.4% reported that they will probably buy a h-axis, high efficiency washer in this time period. The survey found that a major reason for consumers not opting for the h-axis machine was awareness of the technology and its benefits in terms of cleaning performance, reduced operation cost, less water use, and lowered energy consumption. Other work has confirmed that increased awareness of the benefits of high - efficiency washers is the key to transforming the market.[3]

Water Savings: Applying national averages to the Tucson area it is estimated that (6%) 10,667 of all households purchase a new washer annually. If three percent of all Tucson area homes convert to h-axis washers, the water savings would equate to approximately 98 acre feet (31,819,350 gallons) per year. Replacement of only 300 standard washers with h-axis washers would equate to a savings of approximately 6 acre feet/yr (1,918,800 gallons). That's enough water to meet the requirements of 48 persons per year @ 111 gallons per capita per day (gpcd). The estimated reduction per household (2.4 persons per housing unit) of 5 - 7 gpcd on an annual basis would greatly assist municipal water providers in meeting ADWR gpcd targets.

Monetary Savings: Based on customer survey's of two of Tucson's largest water providers an average of 94% (177,775 households) of their single family residential customers own clothes washers.[4] Applying the Bern Kansas washer study and national averages for energy and water savings, to average Tucson water and energy rates equates to an estimated annual per household (single family) savings of between $100 and $160 per household; $14/yr for water, $67/yr in electricity or $16.25/yr for natural gas to heat the water and an average of $7.60/yr in reduced sewer fees. Additional savings realized through shorter dryer cycles are approximately $19 for

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2 Bern Clothes Washer Study authored by J.J. Tomlinson and D.T. Rizy and prepared by Energy Division Oak Ridge National Laboratory for the U.S. Department of Energy, March 1998

3 Bern Clothes Washer Study authored by J.J. Tomlinson and D.T. Rizy and prepared by Energy Division Oak Ridge National Laboratory for the U.S. Dept. of Energy, March 1998

4 Tucson Water (T. Arnold, 1992) and Metropolitan Domestic Water Improvement District (C. Kuranz [Bickelmann], 1994)

electricity or $5 for natural gas. According to E-Source[5] at a conservative cost estimate of $.07 per ounce, an average household could expect cost savings of $54 per year from a two-third reduction in detergent use.

Partnerships: In 1998 ADWR signed a memorandum of understanding with the Department of Energy (DOE) and Environmental Protection Agency (EPA) to work conjunctively with their "Energy Star" program to promote increased market penetration of h-axis washers in the Tucson area. H-axis washers were added to the appliances being promoted by Energy Star in the summer of 1997. In addition, a working committee has been formed which includes U.S. Bureau of Reclamation; Tucson Electric Power (TEP); Tucson-Pima Metropolitan Energy Commission and Tucson Water.

Phase I - Local and Regional Data Collection

ADWR set up a booth in conjunction with the Wash Wise Committee at the annual Spring Southern Arizona Home Builders Association (SAHBA) Home Show in April of 1998. The booth allowed the group to promote water conservation, conduct a survey to determine how much if anything local residents knew about h-axis washers and begin to inform the public of the water and energy conservation benefits inherent in h-axis washers. (See Public Perception Survey below). A discounted Maytag Neptune was purchased from a local retailer who set it up and removed it at the end of the show and delivered it to the winner.

ADWR participated in the spring SAHBA Home Show on April 2-5, 1998 in conjunction with Wash Wise Committee members. The consulting firm facilitating the Energy Star Program D & R International, Ltd located in Maryland provided the Energy Star display featuring the environmental advantages of energy and water efficient appliances. They also worked with the committee to develop display graphs depicting the potential water, energy and monetary savings based on varying percentages (25%, 50% and 100%) of market penetration of h-axis washers in the Tucson area. In addition, various water conservation programs supported by ADWR such as Casa del Agua, and the Water Conservation Education Maze were also featured.

Public Perception Survey: A short survey was developed to gather general demographic information and collect data on public awareness of the h-axis washer technology. A chance to win the washer also served as an incentive to Home Show attendees to complete the survey and a very cost effective way to conduct the survey. Additional questions were included to find participants with standard washers, who were interested in purchasing a front loader in the next few months. Five hundred eighty two surveys were completed during the three day event (see survey results Appendix A). One survey was randomly selected at the conclusion of the Home Show to receive the new Maytag Neptune clothes washer. The winner was Mrs Jane Hall of

[5] Residential Appliances, Clothes Washers, Chapter 6, E Source, 1994

Tucson. The total survey cost was under $2,000 which included the cost of the washer and over $900 for the booth space, both contributed by the Bureau of Reclamation. The survey was printed by TEP who also input the data into a database.

Of the 582 survey respondents 149 households indicated they were interested in purchasing an h-axis washer in 1-6 months. A follow up letter was sent to 124 households to determine willingness to participate in a two month "laundry diary." Six households indicated they had already purchased an h-axis washer after seeing it at the home show. Another 5 indicated they would be able to participate in the study during the peak water and energy use months of July and August 1998.

Laundry Diary: Ultimately four households agreed to participate in a two month study to record their laundry habits. Data was collected for 30 days with their current clothes washer. The same households purchased an h-axis washer of their choice and continued their "laundry diary" and metering for an additional 30 days. Conducting the actual laundry diary requires each participant to fill in bubbles on a form for each question with ink or pencil for each load, load size, temperature settings, amount of soap used, type of dryer used etc.. The form was developed to use optical marker ink head readers. This allows data collected to be read by a special scanner and placed in a database for analysis. The optical scan forms were developed based on a form from a similar study conducted in Bern, Kansas by Maytag. Forms were modified by the Tucson Unified School District (TUSD) print shop to make all questions scannable to avoid manual data input of date, load weight and meter readings. The costs of development and printing of laundry diary forms, standard laundry baskets and detergent measuring cups for participants were contributed by The Metropolitan Energy Commission. Electronic postal scales to weigh laundry loads and brochures were purchased with ADWR grant funds. Hot water meters for the study were contributed by TEP and The Metropolitan Energy Commission. Tucson Water provided the cold water meters. Both meters were installed by Tucson Water "Zanjero" staff (a residential water audit program) the first week of July, 1998.

Results of the study show that water use in the Tucson area can be greatly reduced by replacing top loading washers with h-axis washers (See Appendix B for laundry study results). The study verified manufacturers claims of 38-40% reductions in water use. Standard washers in the study averaged 41 gallons of water per load. H-axis washers averaged about 26, a savings of 15 gallons per load. Energy savings were more difficult to ascertain since one participant had a solar water heater, one washes exclusively in cold water and the remaining two households lived in apartments which had central water heaters, making the water temperature difficult to determine.

Brochures: Working with Energy Star ADWR printed 7,000 brochures entitled "Getting More for Your Money, How to Buy an Energy Efficient Clothes Washer" describing the water and energy advantages of h-axis washers. In addition, an insert was developed by the committee showing the potential water and energy savings both to the region and in monetary terms, using Tucson water and energy rates. These brochures were distributed at the 1998 SAHBA Home Show and continue to be distributed by committee members, agencies and other water companies throughout greater Tucson.

Preliminary Trends: Based on the information collected to date the "Wash Wise" committee has concluded that although the cost of purchasing the h-axis washers is substantially higher than the traditional top loading washers ($700 - $1,100 v.s. $300- $600) they are selling well, both nationally and locally. However, it appears that they are being purchased predominantly by higher income residents, or those with a higher level of commitment to energy and water efficient products and technologies. The local Home Show survey confirmed that the majority of households intending to purchase a h-axis washer within 1-6 months had higher incomes (over $45,000 per year) and were predominantly over 45 years of age. Additional survey results can be found in Appendix A.

With the average lifetime of a washer estimated at 13 years for a standard washer and 10 yrs for compact model (DOE 1994), the initial increased purchase cost for the h-axis washer would be offset by the water and energy savings in 2-4 years and save the consumer $1,000 or more depending upon utility rates, over the life of the washer.

The committee also researched a variety of financial incentives to promote the purchase of h-axis washers (e.g. "Energy Star" or local bank credit card with reduced interest rate or 90 days same as cash for purchases of water and energy efficient products; purchasing in volume to bring down per unit price) during the first phase feasibility study. However, it does not seem feasible at this time for ADWR or other committee member organizations to underwrite interest rates or to find a financial institution to offer a special credit card limited to purchases of energy efficient products. Rebates may still be an option if a substantial commitment of funds is made by other than ADWR e.g. local water companies. Another possibility would be to work at the state level to initiate tax credits for energy and water efficient products (including h-axis washers) modeled after the credits now offered in the state of Oregon.

Retailer participation: In October of 1998 a short survey was sent to 28 retail appliance stores throughout the Tucson area that sell clothes washers. The primary focus of this survey was to determine: 1) which retailers currently sell h-axis washers or plan to in the near future, 2) which brands they sell, 3) retailer and customer perception of the washers, 4) interest in participating in a promotional campaign to educate the public of the water and energy saving features of h-axis washers and, 5) interest in participating in programs with other retailers (e.g. volume purchasing). Twenty one percent (6) of the surveys were completed and returned. Of those returned 5 retailers indicated interest in learning more about cooperative opportunities to promote h-axis washers in Tucson. A meeting will be scheduled with retailers in the spring to discuss the kick off of year two of the grant, which will promote water efficient technologies and habits. This should provide and opportunity to get input on what materials should be developed and to focus the water conservation campaign.

Future Directions: The second year of the program has been revised from the original proposal. The proposal will develop a regional education program which highlights the water and energy savings of various conservation measures and products including the h-axis washers, rather than a rebate program.

The primary reasons for not pursuing a rebate program at this time is: 1) the limited funds available from the Conservation Assistance/Augmentation (CAA) grant program, the amount of money necessary for a rebate program would have to be substantial to be effective. The committee estimates $150 - $300 per washer would be needed to bring the cost down to that of a comparable top loading washer, 2) there appears to be limited interest by most of the participating entities in providing funding for rebates. However, Tucson Water is researching the possibility of pursuing rebates for their customers, 3) the remaining larger water providers are focusing their efforts on outdoor water conservation programs rather than interior programs at this time and are currently assessing cost effectiveness of various options for future conservation programs prior to embarking on any new programs, 4) there are other options for making h-axis washers more affordable as mentioned earlier instead of rebates, which would not require program management by ADWR or committee members.

Providing information on water and energy savings associated with h-axis washers and other products will help consumers make a more informed decision and understand the connection between resource (water and energy) consumption and regional water supply issues. The need for conservation, recharge and use of renewable supplies (treated effluent and CAP) will be featured.

Continuation of the "Wash Wise Program" will consist of: 1) development and airing of TV public service announcements (psa's) promoting regional water conservation. This will include some purchased air time to be funded through the Conservation Assistance Program or through a partnership with a local station. The psa (s) would highlight regional water supply facts and encourage a variety of personal choices people can make to reduce water waste and over consumption. One component will feature products (e.g. the h-axis washer) with potential for major water savings in the Tucson basin; 2) utility bill inserts on h-axis washers funded and distributed by TEP and; 3) a regional water conservation display including water efficient technology options, to be funded by the U.S. Bureau of Reclamation. The display would be used in public locations and/or at local community events and made available to ADWR "Wash Wise" committee members, local water or utility companies and others.

Laundromats: The committee may also conduct a survey of local Laundromats to determine 1) the percentage of h-axis washers in use and associated manufacturers/models, 2) perceptions of owners, managers and customers of the these washers in comparison to standard washers, 3) any real or perceived economic advantages in terms of water and energy savings and, 4) interest in participating in volume purchase programs with other, Laundromats, retailers or manufacturers.

Appendix A

Tucson H-axis Public Perception Survey Results

SAHBA Home Show, April 2-5, 1998

SUMMARY OF HOME SHOW WASHER SURVEY RESULTS

Total number of surveys completed = 582

1) Including yourself, how many people live in your home:
1 person = 57 2=**258** 3=81 4=64 5=27 6=13 7=2 8=3

Average =2.3 per household

2) Please check you age group:

.02% 13 Under 25
14 % 75 25 - 35
23 % 126 35 - 45
24 % 133 45-55
36 % 199 55 and over

3) Which of the following best describes you total household annual income

6 % 28 Under $15,000
12% 54 $15,000 to $24,999
14% 67 $25,000 to $34,999
18% 83 $35,000 to $44,999
20% 92 $45,000 to $54,999
30% 141 $55,000 and above

4) Do you own a washing machine
83% 483 = yes no=99

If yes, approximately how old is your washing machine (in years)
(1 yr)=28 (2)=27 (3)=25 (4)=17 (5)=40 (6)=14 (7)=24 (8)=40 (9)=6 **(10)=69** (11)=4 (12)=17 (13)=4 (14)=9 (15)=33 (16)=3 (17)=7 (18)=5 (19)=1 (20)=16 (21)=1 (22)=5 (23)=1 (25)=3 (27)=1 (28)=1 (30)=2 (35)=1 (42)=1

Average washing machine age = 6 years

5) Have you ever heard of, or seen horizontal axis/front loading washing machines?
290 = yes **no=292**

If yes, where:

50-TV, 1-MTV

STORES: 44
7-store, 12-Sears (1-Sears training), 7-Maytag store, 5-Christie's Appliances, 4-Best Buy
4-Circuit City, 3-Wards, 1948-Yankton SD appliance store, 1-Westinghouse,

PRINT ADS/ARTICLES: 32
4-read about them (1-at library), 9-Ads, 9-magazine (1-Phoenix Home and Garden), 2-Consumer Reports, 5-newspaper articles, USA Today, read article
Hotel,

OTHER COUNTRIES: 20
11-Europe, 2-Germany, 4-England, 2-Canada, 1-Namibia (SW Africa)

HEARD ABOUT THEM: 15
2-heard someone talking about them, was told about it, 2-friend, sister owns one, relative, daughter has one, grew up with one, my mother's, friends house, 50 years ago, 3-years ago (1-in Sears), older house

LAUNDROMAT: 14
(1 mentioned Bendix washer), commercial types are of this design, my Laundromat, Laundromat when I was little

HOME SHOWS: 13
12-SAHBA Home Show, 1-another home show

OWNED ONE: 9
6-had one years ago (5-Bendix 1940's, 2-Westinghouse), 3-home (own one, owned an old one),

CITIES mentioned: 1-Tucson; 1-Eagle, Arkansas; 1-Phoenix
1-ADWR/Tucson Water
1-don't remember
2-Casa del Agua

6) Have you ever owned or operated a horizontal axis/front loading washing machine?
81 = yes **no = 501**

7) Based on what you have seen or heard about these washers, what is your overall impression of them?

WATER/ENERGY SAVINGS
I think it's great-anything to save $; expensive, but saves water; energy/water efficient; 2-Energy savings, less money to operate; all over more efficient; 2-saves water/use less water; they are efficient; they are very functional and good for the earth; the concept is intriguing, I'm very interested in water conservation; they're very good and you also save; water and energy savings; great concept environmentally friendly; 2-this machine is very impressive, especially the conservation aspect; low water use; very important for future households to conserve energy & water; great but expensive; Interesting; save energy and water; great savings; good deal as far as water and usage; I think they are neat and energy efficient; nothing better on the market; less washing, less energy; better extraction; wonderful; I suppose they are efficient; water saver; its always a good idea to conserve water; will save money, water and less harsh on clothes; excellent, efficient and great for the environment; they are very expensive and do a better job; saves water; save water, clean better; top notch; energy saving; I like what I've read; it's what a person living in Tucson needs!

PERFORMANCE
It appears it could do a good job; 2- seems/sounds like a great idea; 2-sounds good; 2-sure would like to try it; great improvement; seems great; they are superior; 3-very interesting concept; large/economical to use; large capacity, economical; no water comes out; different, same end result; 3- better than v-axis, much better than the usual machine-cleaner, drier etc.; efficient cleaning, would like to test one; had one 50 yrs ago, I was very satisfied with the machine I had at the time; smaller load capacity but more efficient; they seem a lot easier to use; good cleaning; I like them they are more gentle on the clothes; great, able to put more "stuff" in; only used one at a Laundromat for oversized stuff; should clean better; hold more; better on clothes, cleaner results; I loved the one I had they can't be beat!; my next purchase will be front loading; had a Bendix washer with dryer-liked it; looks very promising; I liked mine;

COST- high priced; can't afford it; excellent but too expensive; good deal; 3-great, like price

AESTHETICS - look great; look neat; 3- looks good; look pretty;

SUPERLATIVES!
amazing; 2-wonderful; 3-good idea; 22-great; 4-neat; 23-good; 8-very good; 7-excellent; 3-OK; 5-impressive/very impressed; 3-very nice; 6 - I want one, really different; 4- like them; own one I love it; Terrific! ; 3-awesome; cool; not sure; will replace current one with it when it dies!; I think its fantastic; 2-nice; super; 2-positive; fantastic we will be buying one in a few years; very impressed; a friend swears by these; have no knowledge-no opinion formed;

MORE INFO/QUESTIONS - fair, I would like to get more info; not enough info; sounds terrific, excellent need more info; do they work;

8) Would you be willing to purchase a new horizontal axis/front loading washing machine and participate in an eight week diary program to compare your current washer with a new horizontal axis washer for which you would be paid $150?

Yes **17** I am planning to buy in 1 month

40% = 55+ years of age	10% earned $55,000+
40% = 45-54 years of age	40% earned $45,000-$54,000 annually
10% = 35-44 years of age	40% earned $35,000-$44,999
10% = 25-34 years of age	10% earned $25,000-$34,999

Yes **19** I am planning to buy in 3 months

70% = 45-55 years of age	55% earned $55,000+ annually
20% = 35-44 years of age	45% earned $45,000-$54,999
10% = 25-35 years of age	

Yes **113** I am planning to buy in 6 months

40% = 55+ years of age	40% earned $55,000+ annually
40% = 45-54 years of age	35% earned $45,000-$54,999
15% = 35-44 years of age	15% earned $35,000-$44,999
5% = 25-34 years of age	5% earned $25,000-$34,999
	5% earned $15,000-$24,999

No **273** I am not interested at this time

Appendix B

Tucson Laundry Diary

Temperature Measurements - At the beginning of the study Tucson Water staff visited each participant to install water meters on each washer and conduct a short pre-program survey (Fig. 1). The survey collected data on the participants water, gas and electric providers and account numbers. Information on washer and dryer model, brand, age capacity, load size selections, temperature selections, whether the appliances were purchased new or used and if the dryer was gas or electric was recorded. Water heater model, brand, capacity, temperature setting, age and whether the water heater used natural gas or electricity was also recorded. Each participant was assigned a house code number which allowed the information collected in this pre-study survey to be linked to laundry diary survey results.

Water Meters - Two water meters were installed on each washer in the project, one to measure hot water consumption (Turbine Meter model FTB-4107) and the other for the cold (Rockwell Model S-04 _"). Each meter measured in gallons. Participants were asked to read and record the hot and cold meter readouts after each load of laundry was completed.

Weighing Scale - Each participant was given a electronic scale for weighing wash loads both prior to washing and after washing was completed, but prior to drying the laundry. The scales have a 150 lb. weighing capacity and weighs in .25 lb./10 kg increments. Automatic zero and tare eliminates manual adjustments. The LCD display can be remote mounted on a wall up to 6 feet from the scale which makes it easier to read the weight with the laundry basket on the scale. The team conducting the Bern Kansas study for Maytag indicated that the spring action radial dial scale they had used proved difficult for participants to use (e.g. to balance the laundry basket on the scale and to read the weight while the basket was on the scale).

Laundry Basket - Each participant was given a standard laundry basket for weighing the loads for consistency.

Measuring Cup - Each participant was also given a 2 cup capacity measuring cup to determine detergent use for each load.

Data Sheets/Laundry Diary instructions - All participants were given folders containing the optical marker data sheets to be filled out for each load of laundry throughout the duration of the study for both the top loading and h-axis washers. Item 1 participants indicated the washer type they were recording, item 2 recorded the month, day and time the load was being washed. In items 3 and 9 participants recorded the pre-wash and post-wash load weight of the laundry to determine residual moisture prior to drying the laundry. Items 4, 5, 6, 7, 8, 10 and 11 provided information characterizing the load, use of fabric softener, amount of detergent, machine settings, meter readings for hot and cold water use, whether participants were satisfied with washer performance in cleaning the laundry and how the laundry would be dried. House codes on the bottom of the data sheets were assigned by the Tucson Water staff person when participants began the study.

Results of the Tucson Laundry Diary Study:

BEFORE WASH

1) Washer Type/number of loads per month all households
74 - Top load 62 - Front Load (h-axis)

Average projected loads per household per year
962 - Top load 806 - Front Load (h-axis)

2) Month, Day, Time: hour/minute

Top Load, Summer Rates:	44 - Off Peak	24 - On Peak	8- Shoulder
H-axis, Summer Rates:	24 - Off Peak	7 - On Peak	3- Shoulder
Top Load, Winter Rates:	0 - Off Peak	1 - On Peak	
H-axis, Winter Rates:	0 - Off Peak	19 - On Peak	

3) Load Weight (average lbs) after spin cycle
Top Load- dry = 10.12 wet =15.19 weight gain lbs = 5.07
H-axis- dry = 10.97 wet =16.63 weight gain lbs = 5.66

4) How soiled is this load?

Top Load-	2 Very heavy	54 Moderate	13 Heavy Light	4 Very Light
H-axis-	2 Very heavy	35 Moderate	19 Heavy Light	2 Very Light

5) Did you:

Top Load-	6 Pretreat stains	16 color safe bleach	11 fabric softener in washer
	4 Use chlorine bleach	0 Presoak	38 fabric softener in dryer
H-axis-	3 Pretreat stains	18 color safe bleach	14 fabric softener in washer
	9 Use chlorine bleach	1 Presoak	30 fabric softener in dryer

6) Detergent: all participants used ½ cup or less, 1 used a washer ball (ionizer)

Amount ≤ ¼ C = top 61, front 45	Top loader	Front loader
Tide: top-32.43%; front -32.26%	51.35% Powder	46.77% Powder
Tide HE:front -3.23%	48.65% Liquid	53.23% Liquid

All: top-14.86%; front 22.58%
Biodegradable: top-33.78% ; front- 24.19%
Other: top- 18.92% ; front - 17.74%

7) Machine Settings

	Cycle	Wash Temp	Rinse Temp	Load Size
Top:	62.12% Regular	16.22% Hot	4.05% Warm	1.35% Mini
	79.03% Perm Press	58.11% Warm	95.95% Cold	1.35% Small
	14.86% Delicate	25.68% Cold		4.05% Medium
				74.32 % Large
				17.57% X-Large
				1.35% missing data
h axis:	79.03% Regular	1.61% Hot	1.61% Warm	0 Mini
	19.35% Perm Press	56.45% Warm	98.39% Cold	6.45% Small
	1.61% Delicate	41.94% Cold		8.06% Medium
				51.61% Large
				6.45% X-Large
				27.42% missing data

AFTER WASH

8) Water Used in gallons (average 1 month for each type of washer, 4 households)

	Hot	Cold	Average use	Gallons used	%total
top	9.4	31	40.37	2826	65.06%
h-axis	7.1	19	26.2	1518	34.94%

9) Weight damp load- see after spin cycle question #3

10) Satisfaction with cleanability of load

Top Load	**H-axis**
0 - Completely satisfied	35 - Completely satisfied
35 - Very satisfied	26 - Very satisfied
37 - Somewhat satisfied	1 - Somewhat satisfied
1 - Not very satisfied	0 - Not very satisfied
0 - Not at all satisfied	0 - Not at all satisfied

11) How will this load be dried?

50% Dryer	25% Clothesline	25% Some dryer/some line